



**DEPARTMENT OF DEFENSE
FREEDOM OF INFORMATION DIVISION
1155 DEFENSE PENTAGON
WASHINGTON, DC 20301-1155**

JUL 03 2019

Ref: 18-FC-0053
OSTP-FOIA-17-96

Mr. Nathanael King
MuckRock
Dept MR 41768
411A Highland Ave
Somerville, MA 02144

Dear Mr. King:

This is the final response to your August 14, 2017 Freedom of Information Act (FOIA) request submitted to the Office of Science and Technology Policy (OSTP), a copy of which is enclosed for your convenience. We received your request and 58 pages from OSTP on January 4, 2018 and assigned it case number 18-FC-0053. We ask that you use this number when referring to your request.

Mr. Scott McPherson, Director, Chief, IMD Declassification Branch; Mr. Andrew Mendoza, Legal Counsel, Office of Science and Technology Policy, in their capacity as an Initial Denial Authority, has determined that some of the information in the enclosed two documents, totaling 38 pages, is exempt from release pursuant to 5 U.S.C. § 552(b)(6), which pertains to information the release of which would constitute a clearly unwarranted invasion of the personal privacy of individuals. Additionally, Mr. James Petro, Acting Director, Human Systems of Research and Engineering, in his capacity as an Initial Denial Authority, determined that some of the information responsive to your request, totaling 20 pages, must be withheld in their entirety pursuant to 5 U.S.C. §552(b)(5), which pertains to certain inter- or intra-agency communications protected by the deliberative process privilege.

This action closes your request with this office, and there are no assessable fees associated with this response.

If you are not satisfied with this response, you may contact our OSD FOIA Public Liaison, Darrell Williams, at 571-372-0464 or by email at OSD.FOIALiaison@mail.mil. Also, please note that the Office of Government Information Services (OGIS) offers services to requesters who have disputes with Federal agencies. You may contact OGIS if you have concerns about the processing of your request. Their contact information is provided below:

Office of Government Information Services
National Archives and Records Administration
8601 Adelphi Road-OGIS
College Park, MD 20740
E-mail: ogis@nara.gov
Telephone: 202-741-5770
Fax: 202-741-5769
Toll-free: 1-877-684-6448

You have the right to appeal to the appellate authority, Ms. Joo Chung, Director of Oversight and Compliance, Office of the Secretary of Defense, by writing directly to OCMO Directorate for Oversight and Compliance, 4800 Mark Center Drive, ATTN: DPCLTD, FOIA Appeals, Mailbox# 24, Alexandria, VA 22350-1700. Your appeal must be postmarked within 90 calendar days of the date of this response. Alternatively, you may email your appeal to OSD.FOIA-APPEAL@mail.mil. If you use email, please include the words "FOIA Appeal" in the subject of the email. Please also reference case number 18-FC-0053 in any appeal correspondence.

If you have any questions about the foregoing, please do not hesitate to contact the Action Officer assigned to your request, Kris Zadrovitz, kristine.l.zadrovitz.civ@mail.mil or 571-372-0465.

Sincerely,

Stephanie L. Carr
for
Stephanie L. Carr
Chief

Enclosures:
As stated.

From: Epstein, Gerald L. EOP/OSTP
To: Park, Christopher J. [REDACTED] CIV US NDU/CSWMD; ISN-BPS-DL; State Gene Editing WG; State Bio
Directors-Chiefs-Deputies-POCs; Viggiani, Christopher (NIH/OD) [E] [REDACTED] Anna
Muldoon; [REDACTED] [REDACTED] Rebecca Katz [REDACTED] You
Edward H.
Cc: Cameron, Beth E. EOP/NSC; Carter, Hillary H. EOP/NSC; Oehlert, Sean; Bergemann, John C (Geneva)
Subject: Re: Recent NIH funding opportunity announcement
Date: Wednesday, November 2, 2016 6:49:47 PM

S is for "social," but "societal" works. You got the rest.

Sent from my BlackBerry

Original Message

From: Park, Christopher J
Sent: Wednesday, November 2, 2016 6:22 PM
To: [REDACTED] (CIV US NDU/CSWMD); ISN-BPS-DL; State Gene Editing WG; State Bio Directors-Chiefs-Deputies-POCs; Epstein, Gerald L. EOP/OSTP; Viggiani, Christopher (NIH/OD) [E] [REDACTED] Rebecca Katz [REDACTED] Anna Muldoon; [REDACTED] [REDACTED] You, Edward H.
Cc: Cameron, Beth E. EOP/NSC; Carter, Hillary H. EOP/NSC; Oehlert, Sean; Bergemann, John C (Geneva)
Subject: Re: Recent NIH funding opportunity announcement

Sorry to be stupid; remind me what ELSI stands for? Ethical/legal/societal implications?

Sent from my BlackBerry 10 phone of questionable intelligence.

From: [REDACTED] (CIV US NDU/CSWMD)
Sent: Wednesday, November 2, 2016 3:54 PM
To: Park, Christopher J; ISN-BPS-DL; State Gene Editing WG; State Bio Directors-Chiefs-Deputies-POCs; Jerry Epstein; Viggiani, Christopher (NIH/OD) [E] [REDACTED] Anna Muldoon; [REDACTED] [REDACTED] You, Edward H.
Rebecca Katz [REDACTED] [REDACTED] Oehlert, Sean;
Cc: Cameron, Beth E. EOP/NSC; Carter, Hillary H. EOP/NSC [REDACTED] [REDACTED] Bergemann, John C (Geneva)
Subject: RE: Recent NIH funding opportunity announcement

I think this is interesting! Coincidentally I was at the UPMC event earlier today, and had discussions about the term "ELSI" and whether or not it covers everything we might consider important in the emerging technologies space. It was initially used back in the 90s, and used much in conjunction with the Human Genome project. But for a number of the bullets listed below (the first few certainly) then safety and security are also issues (not just ethical issues). In talking about gene editing for example we have separated the 'ethical' conversation from the safety and security conversation.

I don't know whether the outside research community thinks that ELSI includes safety and security but it's worth thinking about/considering.

Thanks for sharing.

From: Park, Christopher J [mailto:ParkCh2@state.gov]

Sent: Wednesday, November 02, 2016 9:45 AM

To: ISN-BPS-DL [REDACTED] State Gene Editing WG [REDACTED]

State Bio Directors-Chiefs-Deputies-POCs [REDACTED]

(CIV US NDU/CSWMD) [REDACTED]

Viggiani, Christopher (NIH/OD) [E] [REDACTED]

Muldoon [REDACTED]

Rebecca Katz [REDACTED]

Cc: Cameron, Beth E. EOP/NSC

Carter, Hillary H. EOP/NSC

Ochiltree, Sean

Bergemann, John C (Geneva)

Subject: Recent NIH funding opportunity announcement

I thought this was interesting – first I've heard of it. Chris V., might it be useful at some point to brief the NSABB on this initiative? It might be of interest, and it might also be a way to generate wider visibility and hence more high-quality applications. The notice was posted by Fogarty, and notes that it includes international research.

Notice of Interest in High Priority Research in Bioethical, Legal, and Societal Implications of Biomedical Research

Notice Number: NOT-LM-17-001

Key Dates

Release Date: October 25, 2016

Related Announcements

None

Issued by

National Cancer Institute (NCI<<http://www.nci.nih.gov/>>)

National Eye Institute (NEI<<http://www.nei.nih.gov/>>)

National Human Genome Research Institute (NHGRI<<http://www.ncbi.nlm.nih.gov/>>)

National Institute on Aging (NIA<<http://www.nia.nih.gov/>>)

National Institute of Allergy and Infectious Diseases (NIAID<<http://www.niaid.nih.gov/>>)

National Institute on Alcohol Abuse and Alcoholism (NIAAA<<https://www.niaaa.nih.gov/>>)

National Institute on Minority Health and Health Disparities (NIMHD<<http://www.nimhd.nih.gov/>>)

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS<<http://www.niams.nih.gov/>>)

National Institute of Biomedical Imaging and Bioengineering (NIBIB<<http://www.nibib.nih.gov/>>)

National Institute on Deafness and Other Communication Disorders (NIDCD<<http://www.nidcd.nih.gov/>>)

National Institute on Dental and Craniofacial Research (NIDCR<<http://www.nidcr.nih.gov/>>)

National Institute on Drug Abuse (NIDA<<http://www.nida.nih.gov/>>)

National Institute of Environmental Health Sciences (NIEHS<<http://www.niehs.nih.gov/>>)

National Institute of Mental Health (NIMH<<http://www.nimh.nih.gov/>>)

National Institute of Neurological Disorders and Stroke (NINDS<<http://www.ninds.nih.gov/>>)

National Institute of Nursing Research (NINR<<http://www.ninr.nih.gov/>>)

National Library of Medicine (NLM<<http://www.nlm.nih.gov/>>)

National Center for Complementary and Integrative Health (NCCIH<<http://www.nccam.nih.gov/>>)

Purpose

The listed NIH ICs are issuing this Notice to highlight their interest in empirical and conceptual research addressing high priority bioethical, legal, and societal challenges impacting biomedical research.

Areas of high priority research include, but are not limited to, the bioethical, legal and societal implications of the following:

- * New and emerging technology development and use, such as: gene drive; precision gene editing; artificial intelligence; brain implants and modulation; human-animal chimeras
- * Clinical and non-clinical data sharing; big data and data science analytics; integration of data for research, including clinical, research, environment, social media, patient provided, and other
- * Precision and personalized medicine; personal, institutional, and research privacy and security
- * Learning Healthcare System; interface of clinical research and clinical care; pragmatic trials
- * Crowdsourcing; participant driven, directed, or sponsored clinical research; Citizen Science and DIY biomedical research
- * Special and vulnerable population research, including pediatric, end-of-life-care, emergency, disaster, and pandemic research; issues in capacity impaired individuals and populations
- * Individual or community health, treatment, and/or research disparities; international research
- * Current and emerging regulatory environments
- * Informed consent issues
- * Innovative study design, conduct, management, and oversight

Possible funding opportunities that can be used to pursue these research activities include:

PA-16-160 NIH Research Project Grant (Parent R01)<<https://grants.nih.gov/grants/guide/pa-files/PA-16-160.html>>

PA-16-161 NIH Exploratory/Development Research Grant Program (Parent R21)<<http://grants.nih.gov/grants/guide/pa-files/PA-16-161.html>>

PA-16-162 NIH Small Research Grant Program (Parent R03)<<http://grants.nih.gov/grants/guide/pa-files/PA-16-162.html>>

PA-16-200 Academic Research Enhancement Award (Parent R15)<<http://grants.nih.gov/grants/guide/pa-files/PA-16-200.html>>

Investigators interested in developing applications for bioethics, legal, and societal implications research are strongly encouraged to discuss their ideas with specific IC contacts listed below prior to submission as ICs have varying levels of interest in high priority areas. Potential applicants should also discuss with specific IC contacts the most appropriate mechanism for their proposed project as all ICs do not utilize all parent FOAs listed above (see hyperlinks for each FOA above).

Applicants should clearly state in the cover letter, Project Abstract, and Specific Aims sections of the grant application that they are responding to this particular NOT. The cover letter should also indicate the IC contact they consulted prior to submission. Applications responding to this NOT should be submitted on the regular application due dates and will be reviewed by NIH standing study sections.

Inquiries

Please direct all inquiries to:

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Email: charlisse.caga-anan@nih.gov<<mailto:charlisse.caga-anan@nih.gov>>

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Wendy Weber, ND PhD MPH
National Center for Complementary and Integrative Health (NCCIH)
Telephone: 301-402-1272
Email: weberwj@mail.nih.gov<<mailto:weberwj@mail.nih.gov>>

This email is UNCLASSIFIED.

From: [REDACTED] (CIV US NDU/CSWMD)
To: Epstein, Gerald L. EOP/OSTP
Subject: RE: Brain Science and the Future of Warfare: a Primer
Date: Tuesday, June 13, 2017 10:08:42 AM
Attachments: image001.jpg
image002.jpg
image003.jpg
image004.jpg
image005.jpg
image006.jpg
image007.jpg
image008.jpg

Aha, Jim is very prolific at the moment on the VX story!
But no I hadn't seen this so Thanks much for forwarding.
I had lunch with Jessica Tucker yesterday and she's setting up something to do
with emerging tech tracking at NIH.

From: Epstein, Gerald L. EOP/OSTP [mailto:[REDACTED]]
Sent: Tuesday, June 13, 2017 9:19 AM
To: [REDACTED] (CIV US NDU/CSWMD)
Subject: FW: Brain Science and the Future of Warfare: a Primer

[REDACTED] don't know if you are familiar with the Center for Policy on Emerging Technologies; you will
probably be interested in this article in any event.

From: Epstein, Gerald [mailto:[REDACTED]]
Sent: Tuesday, June 13, 2017 8:44 AM
To: Epstein, Gerald L. EOP/OSTP [REDACTED]
Subject: FW: Brain Science and the Future of Warfare: a Primer

From: Nigel Cameron
Sent: Wednesday, May 24, 2017 6:05:19 AM
To: Epstein, Gerald
Subject: Brain Science and the Future of Warfare: a Primer

[REDACTED]

Thank you for your participation in the C-PET network!

Image removed by sender. C-PET



In Washington
Independent
Always grateful for your support -
please help!

Dear Gerald

I thought you would be interested to see this important summary of the state of play in brain science and warfare from Georgetown professor and C-PET Senior Fellow Jim Giordano. If you'd like to respond direct, he's here.

Nigel Cameron

The Future of Warfare and the Responsibilities of Today's Brain Science

Dr. James Giordano

Recent articles in the French (Les Echos) and British press (Daily Mail) have reported that future wars will increasingly involve the use of ever more sophisticated combinations of neural, cognitive, and computational science and technology. Over the past decade, international advances in these areas are enabling greater capabilities to understand - and control - neurological processes of thought, emotion and behaviour, and the power conferred by this knowledge and control certainly has not been overlooked by a number of the world's militaries. Drugs and various forms of brain stimulation can be used to optimize the performance of military personnel, which some view as affording potential to create "super soldiers". What's more, brain science can be harnessed to develop weapons that act on the nervous system to produce profound physical effects, and in some cases cause death. Indeed, the recent use of sarin gas and the nerve agent VX has prompted renewed discussions about the continued availability of neurological weapons, and the viability of dual-use applications of neuroscience research.

The United States government communicated that development and employment of so-called neuroweapons '...crosses a line'. Clearly, the "line" represents waiting to see if such neuroweapons will be developed, and what threat they pose. In crossing that line, it is now time to pursue and obtain a deeper, fuller and more realistic understanding and regulation of the ways brain science can be put to such "dual use" in military and warfare agendas. Increasingly more sophisticated and ever more capable techniques and technologies of brain science are being viewed for their potential to create neuroweapons that are more specific in their ability to affect thought, emotions, behaviour, and health. More selective drugs , microbes, toxins and a variety of devices - including unmanned autonomous vehicles with computerized "decision-making systems" that are modelled after neurological networks - can now all be engaged as weapons. So, while sarin and VX are class 1 agents under the current Biological Toxin and Weapons and Chemical Weapons Conventions, their recent use serves as a reminder - if not wake-up call - that these substances are still around. But as noted by the Australia Group at the Eighth Review Conference of the Biological Toxin and Weapons Convention late last year, current conventions that define and restrict the use of biological and chemical weapons do not necessarily account for newer developments in neuroscience and neurotechnology, and so a more precise examination and perhaps classification of dual-use brain science may be in order.

Ongoing efforts [1] of the Ethics & Society Subproject 12 of the Human Brain Project (HBP) are focusing on thoroughly reviewing what constitutes 'dual use' applications of brain science , both within the HBP and more broadly, and recommending policies for neuroscientific research that can be employed in such ways [2]. As noted in one of the forthcoming SP12 reports, these recommendations include: establishing a permanent working group to address and assess HBP activities with potential for military-warfare uses; engaging this working group in discussions with various national defence and security organizations and the public; and developing an educational program to provide seminars, webinars, publications, and online informational material for HBP groups, as well as the public and governmental agencies that addresses military-warfare use of HBP efforts. Moreover, it was recommended that the HBP update its mission statement to proscribe specific military-warfare applications of its programs' research, and that

it establishes requirements for all HBP research personnel to explicitly affirm such proscription, and be prohibited from receiving military funding both during their tenure in HBP-supported activities, and for a defined period of time subsequent to their involvement.

This approach calls for responsibility for accurate assessment of research, proactive responsiveness and engagement by researchers, revision of identified research efforts that pose concern, and efforts toward regulation of brain research that can be used in military and warfare agenda. This is laudable and noteworthy, even if only as a first step. But more imposing issues remain: such research will still likely be conducted by individuals and groups that do not heed proposed guidelines or policies; and while it may be possible to guide and regulate brain research (at least to some extent), the actual use of brain science to improve performance of military personnel and to develop neuroweapons is far more difficult to control. But these challenges can also be regarded as opportunities - and calls - for action. Scientific committees and political organizations should engage discussions to acknowledge and assess the current and potential risks and threats posed by brain science, and the international community of brain scientists and ethicists should become ever more participatory in informing and developing policies and regulations to govern dual-use neuroscientific research and its applications. History has provided ample evidence that science and technology afford great power, and can be used to harm as well as heal. With further strides to explore and control the brain, it becomes crucial to pay close attention to each and every step we take in the present, so as to maximize the benefits, and meet and mitigate, if not prevent, the risks and threats of what brain science may portend for the future.

Dr. James Giordano is Researcher in HBP's Neuroethics & Philosophy Group at the Centre for Research Ethics & Bioethics, Uppsala University. He is Professor in the Departments of Neurology and Biochemistry, Chief of the Neuroethics Studies Program in the Pellegrino Center for Clinical Bioethics, and Co-director of the O'Neill-Pellegrino Program for Brain Sciences and Global Health Law and Policy at the Georgetown University Medical Center.

[1] Reports of the SP12 Foresight Lab and the SP12 Neuroethics and

Philosophy Group on Dual-Use will be available for public view in the future; please visit the HBP website for announcement of release.

[2] Recommendations are supported by findings from an SPI2 seminar held at the European Institute for Theoretical Neuroscience in March 2016 featuring participation from international experts on dual use of research and HBP researchers. The full report can be found [here](#).

There's no question that the two major parties are offering widely contrasting visions of the future.

As they trade control of the legislative and executive branches of the federal government, budgets, fiscal and social policy, even foreign policy, get re-vamped. But as we've long argued here at C-PET, the time-horizon of the United States government is extraordinarily limited. The electoral cycles - two, four, and six years - make that the easy way to do government. And since the corporate lobbyists who play such a big role in shaping what happens know that too, their efforts if anything worsen the bipartisan short-termism that some of us believe is the single biggest problem confronting America. As the top lobbyist of one of our major tech companies once told me, "my job description says I'm only to think 18 months ahead."

By contrast, we at C-PET, now in our tenth anniversary year, have always been a voice for the longer term. We're here to ask "tomorrow's questions." It's one reason (I have often been told) that corporations have not been flocking to fund us. Their SS target institutions that will help them directly - with Congress and the agencies. There's nothing wrong with that, although this excessive short-term focus will ultimately be disastrous for America.

So, since they don't fund us, we look to you! And since we also don't play the not-for-profit year-end "fund us or we shall close" game, here's a mid-year chance for you to put your hand in your pocket and help us keep moving. Some of those in our network can chip in

sizeable sums. Others can't, and we're happy to have your help also. Let's start the bidding at \$5K. \$1K, anyone? Other offers? As you know, we make rather good use of what funds come our way. Here's the link for credit/debit card contributions. Would you please help out?

Thank you so much!

Best regards,

Nigel Cameron
President and CEO
Center for Policy on Emerging Technologies (C-PET)
Washington, DC 20002

P.S. (All the best fund-raising letters include a P.S. or two) - here's that link again!

FROM EARLIER NEWSLETTERS

I'm just back from the two events in Europe in which we partnered with our friends at Forum, the 8th Internet of Things European Summit on 4/19 and 20, and Connected Cars Europe 2017 - on 5/11. Among other roles I was pleased to offer closing remarks at both these events, and thought you might be interested to see the comments I offered at the end of the cars conference.

The "connected cars" phenomenon has proceeded at a remarkable pace. A new car today comes with between 100 and 200 million lines of code built-in. One presenter shared an early slide of cars as mobile phones; today they are fully-fledged PCs. The move to self-driving, already beginning, seems unstoppable.

The link above will give you many more details, but suffice it to say that just as the equivalent event in Washington last year was

opened by the then U.S. Secretary for Transportation, this Brussels conference began with a keynote from the European Transport Commissioner.

Here are my comments. Your responses, as ever, will be read with interest.

CLOSING REMARKS: BRUSSELS, May 11, 2017

Let me make four brief comments as we end our day together.

1. This conference is of course a spin-off from the series that Forum Europe has hosted, both here and in the U.S., on the Internet of Things. C-PET has been delighted to partner with Forum, not least as together with Dan Caprio, now of The Providence Group, and Mike Nelson, now at Cloudflare, we hosted Washington's first ever conference on IoT. The fact that we now have the major auto manufacturers focused on connected cars and beyond that self-driving vehicles shows how far IoT has come, and how fast. It was only back in 2004, at a time when many believed autonomous vehicles were generations away, that DARPA began its challenge program; 13 years is a long time in Moore's-Law terms.

2. The panel today that most caught my attention was that on trust and confidence, and it's plain that this will be the core issue as we move forward. It was no coincidence that we also heard clear statements that consumers need to be much more involved in this discussion. And this raises many issues that technology people, and perhaps companies, need to appreciate more seriously. For one thing, consumers in general have little idea how advanced our technologies now are. They don't go to the showroom to ask the dealer how many lines of code are in the cars. The public mind has been little informed about what lies ahead, and indeed what is there already. How will the security and privacy issues play out as they become more alive to developments? Since we now have major manufacturing companies on the stage, not simply the tech gurus and consultants who were discussing these things in the past, we may expect a rapid maturing of the conversation. Else no-one is going to make any money in the market.

3. That focuses the core issue of resilience - not simply in our systems, but the resilience, as it were, of the public mind. I do hate to say this, but things are going to go wrong. People are going to die. Whether through systems failure or hacks or some other cause. The more connected we are, the more we raise certain risks. We know this, but I will tell that that it alarms me how uncandid are our discussions of it, Even somewhere like this. The public is used to vast hacks and data loss. They don't much care about it any more. How will they respond when things go wrong with our connected car systems? The problem of course is partly one of new tech versus old. There are 1.25 million road traffic deaths every year worldwide. In the U.S. there are 40,000 - and that number has jumped 25% recently because of tech-driven "distracted driving." We may well believe these systems to be much safer. But what happens when someone dies? How will the public respond? We need to approach both risk and perceived risk in a mature manner.

4. Looking ahead, I wonder whether we are sufficiently prepared for the scale of disruption this particular application of IoT will bring in its train, and that is an issue of which policymakers need to be especially aware. As I argue in my book Will Robots Take Your Job? A Plea for Consensus the advent of autonomous vehicles is likely to have dramatic impacts on everything from insurance to healthcare and, crucially, to the market for autos - if as many believe we move increasingly to a utility/fleet system, with apps summoning cars like Uber or Lyft though without drivers. The average family car is presently unused for between 95% and 97% of the time. Do the math yourself.

There will of course be so many benefits - cheaper, safer, transportation, cuts in pollution, quieter roads. But for manufacturers? Not so simple.

All in all, as our discussion matures, I urge candor as we look ahead.

Best regards,

Nigel Cameron

President and CEO

Center for Policy on Emerging Technologies

Washington, DC, 20002

From recent newsletters:

I'm very pleased to share with you this essay from our C-PET colleague Dr. Nagy Hanna, based on his recent book **Mastering Digital Transformation**. Drawing on his lifetime's experience with the World Bank he sets ICT transformation in a global perspective.

On recent reviewer put it like this:

The author has a wealth of experience in planning and implementing IT strategies for the World Bank and alongside national public/private partnerships around the world. This book is the product of over four decades of work by a leading thinker and represents current best practice in mobilizing IT for society, education and accelerated economic growth. From developing a shared vision across stakeholders; to uniting government-wide activities into a powerful and focused IT promotional architecture; to leveraging a dynamic private sector- this handbook covers an array of crucial topics and effectively uses real world cases and successful practices. Development practitioners and students, industrial promotion strategists and business investors can all benefit from the lessons learned laid out in this book. As a professor in a business school who teaches about innovation and technology management, I recommend this book highly.

Best regards,

Nigel M. de S. Cameron

President and CEO

**Center for Policy on Emerging Technologies
Washington, DC 20002**

***Mastering Digital Transformation:
Towards a Smarter Society, Economy, City, and Nation
(Emerald, 2016)***

by Nagy K. Hanna

Digital technologies have yet to deliver significantly and equitably for developing countries. Why? How can policy makers harness the digital revolution for accelerated development? This is the focus on my recent book, *Mastering Digital Transformation: Towards a smarter society, economy, city and nation* (Emerald, 2016).

The book emphasizes digital transformation as the key to reap the promised benefits of the ongoing technological revolution. Accordingly, digital transformation is not a technological fix, a blueprint plan, a one-off event, or a one-size-fits-all strategy. Rather, it is a social learning process, sustained over time, involving diverse stakeholders with the aim to harness the digital technology revolution and its accompanying information revolution to transform economies and institutions to meet socio-economic priorities, needs and aspirations. This transformation process is driven by vision, leadership, entrepreneurship, innovation, experimentation, openness, agile learning, and partnership among government, business, and civil society.

Digital technologies hold the promise of becoming a game changer for global development. But the much-anticipated developmental promise of this technological revolution remains only a potential. The developmental dividends of digital technologies- inclusive and sustainable growth, improved governance, and responsive service delivery - have been so far limited to isolated cases. They do not add up to transformative development impact. Diffusion, scaling up, and effective use of innovations are what ultimately matters for any significant socioeconomic impact.

Not harnessing the ongoing technological revolution and its innovations is not an option. Given the magnitude of change in competitive advantage that digital technologies can confer on adopters, the risks of slow or poor adoption of these innovations can be similarly dire for industries, governments, individuals, and nations. The ambitious Sustainable Development Goals, adopted by UN members in 2015, would not be attained without harnessing the digital revolution.

Challenges to Digital Transformation

Three key challenges bedevil the design and implementation of digital transformation programs that aim to realize the developmental impact of digital technologies.

First, digital technologies, infrastructures, platforms, and core applications are highly interdependent and should be treated holistically as a dynamic ecosystem. This ecosystem can be conceived to include these components: information and communication infrastructure (connectivity), digital platforms for identification and payments, a local ICT services and digital entrepreneurship sector, technical ICT skills and leadership, content and media industries, digital applications for government and business, digital service provision for all sectors, e-education, enabling cyber policies, and ICT-sector management and regulatory institutions. Maximizing digital dividends requires assessing and nurturing this digital ecosystem and tapping into its synergies at the national, cluster, and sector levels.

Second, the capabilities to plan and implement national digital transformation strategies are increasingly important to engender a shared vision and mobilize a long-term commitment to digital transformation; to integrate ICT opportunities and investments into national and sectoral development strategies; invest in broadband infrastructure and shared digital platforms; reform complementary policies; engage stakeholders; pursue partnerships with civil society and the private sector; secure wide diffusion and inclusion; and enable local initiatives, adaptation, and learning. A

digital transformation strategy should be developed in continuous interaction with the national development strategy and as a crosscutting enabler of priority economic sectors. Attention to building local policy and planning capabilities is much needed: to provide strategic direction, to plan and implement digital transformation, and to adapt planning processes to diverse local contexts and stakeholders.

Third, digital transformation demands substantial investment in organizational capabilities, process innovation, and institutional learning. Substantial investment is needed to implement organizational changes, process innovations, and other intangible digital assets (such as digital content) to realize the promised digital dividends. Little attention is given to this technological and institutional learning capabilities in developing countries, where these capabilities are most needed. Yet, best practice suggests that investments in ICT-related process improvements, training, and reorganization, exceed investment in ICT by a ratio of 4 or 5 to 1. These capabilities involve deep changes in skills, roles, norms, routines, teamwork, cross-sector partnerships, and leadership and managerial practices.

These challenges have persisted across countries, prominently in developing countries where complementary assets and coordination mechanisms are weak or missing. These are due to several institutional factors, including fragmented responsibilities for policies and leadership across government and the whole ICT ecosystem, and the relative isolation of ICT sector specialists from development specialists in education, governance, and other providers of complementary assets.

The book offers tools, frameworks, and best practices to address these challenges. Herein lies the opportunity to make the great leap for digital transformation. It proposes an integrative framework to guide the thinking about the ICT-enabled transformation ecosystem, and its main components and key players, in order to pursue coherent policies and mutually reinforce ICT-enabled development initiatives. The framework helps policy makers and stakeholders engage in identifying the interdependencies, missing

links, and binding constraints in the e-transformation ecosystem that should be prioritized. It calls on ICT policy makers and regulators to break out of the ICT bubble, and interact with the developmental context to be transformed.

What Are The Transformation Possibilities?

ICT-enabled transformation possibilities are vast and ever expanding. This book focuses on effective practices for transforming government and key service sectors of the economy, as well as transforming enterprises, communities, and cities.

First, the book explores some of the strategic approaches to transforming government: taking a whole-of-government perspective; mobilizing demand for better services, promoting public-private partnerships, and monitoring the performance of service providers, etc. New platforms and practices should be leveraged for public sector transformation: digital civil-identification (digital ID), mobile devices and apps, open government data (OGD), big data and analytics, and cloud computing, among others.

Second, the book illustrates how an integrative view of sector transformation can be applied to the education and learning systems, health systems, financial services, and agricultural extension services, among others. Third, measures to promote digital communities and inclusive information society are explored, such as developing local content, and establishing funds for grassroots innovation.

Fourth, the book reviews the emerging practices of smart cities, discusses the merits of competing approaches to smart cities and calls for adopting an ecosystem view that takes account of all stakeholders.

Final vast area of digital transformation is in business.

The book proposes such policy measures as: access to Internet and digital technologies; use of ICT to reduce transaction costs with government and improve the business environment; policies and

platforms to facilitate e-commerce and open trade; enterprise-based training and learning; Internet-based business development services; and transparent and effective regulation.

How Can Countries Master the Digital Transformation Process?

Mastering the digital transformation process demands upgraded managerial and technical skills, digital leadership institutions and networks, enabling policies and regulations for a digital economy, a high-quality communication infrastructure, and a competitive local ICT industry, with capabilities for fast learning from local and global practice.

The book proposes strategies to strengthen the supply response of educational institutions and reposition them for the smart economy.

It calls on policy makers to define clear roles for government, private sector, and development partners, and to build institutions with the requisite core competencies to orchestrate and implement various elements of the transformation process. It raises the key questions that a regulatory framework must answer. Key steps are outlined in developing broadband strategies to promote supply, mobilize demand, and secure universal access. Finally, the book draws on a large body of experience on how to promote the ICT services industry in diverse contexts and in support of a vibrant digital transformation ecosystem.

What Are the Emerging Lessons?

The concluding chapter sums up emerging lessons from the experience of the leading countries into few mutually reinforcing fundamentals. These are best framed here in terms of a learning agenda for researchers and policy makers of transforming countries:

- **How can a country pursue a holistic and long-term transformation strategy? What can be done to sustain commitment and reconcile the pressures for quick wins with the longer-term investments needed in institutions and foundational projects? How can leaders strengthen the digital**

transformation ecosystem, and exploit the potential synergy among its elements?

- What measures can help align and integrate the national digital transformation strategy with the development strategy? How can local content and applications development be promoted to advance development priorities?
- What complementary factors will be needed, economy-wide and in each sector, to realize the digital payoff? What roles should policies, institutions, and leaders play? How can policy makers secure attention to the softer aspects of transformation, like managing change, skills, incentives, and culture?
- How should policy makers engage stakeholders, build coalitions, and pursue partnerships to create and implement a shared vision? What roles can the local ICT industry and civil society organizations play?
- What measures are necessary to secure digital diffusion and inclusion? How early should affordable access and universal digital literacy be pursued to realize equitable and sustainable transformation?
- What balance should be struck between strategic direction and local initiative? Can both be aligned to create a virtuous cycle of innovation and societal learning?
- How can policy makers support experimentation, innovation, and adaptation? How can they enable fast learning, agile monitoring, and participatory evaluation?

Developing countries have the opportunity to learn from the experience of frontrunner countries while inventing their home-grown best practices. Newcomers like Estonia, Korea, and Singapore have leapfrogged, learned fast, became test beds for innovation, and started to partner and exchange their tools and lessons with the most advanced countries. Learning from these good practices should help countries and local governments build capacity to master the digital transformation process. Mastering this process is likely to be the defining core competency of the 21st century.

From earlier newsletters:

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As we welcome Dr. James Giordano to our network of C-PET Senior Fellows, I took the opportunity to pose him a series of questions about neuroscience and its applications and implications. His wide-ranging replies (with notes attached for those who wish to read further) are pasted below and offer a striking series of insights into some of the most exciting - and consequent - science of the 21st century.

Best regards,

Nigel Cameron

**President and CEO, Center for Policy on Emerging Technologies
840 First Street NE, Third Floor,
Washington, DC 20002.**

INTERVIEW WITH DR. JAMES GIORDANO

NC Jim, we're delighted to have you as part of our C-PET network! Your bio spans quite a range of "neuro" issues - from basic research, to ethics, to defense applications, and more. Can you introduce yourself a little, and talk about how you see your various responsibilities fitting together?

JG Thanks, Nigel; it's an honor and pleasure to be part of the C-PET network. A bit of background. I am a neuroscientist and have worked primarily at the interface of basic to translational research, studying molecular and biochemical mechanisms involved in a variety of neuro-psychiatric states and conditions. My training is in neuropharmacology, neurotoxicology and neuropathology, and so rather early on in my career I began investigating how various drugs, chemicals and toxins could be employed experimentally as probes, clinically to affect disease states, and of course, in dual-use

agendas.

I also have an educational background in philosophy of science and bioethics, and I've put that to work, so to speak, in both basic and clinical research by serving on institutional review boards, data monitoring and human subject protection committees, and the like. Over the past 30 years, my career has allowed me to collaborate with a number of groups, both domestically and abroad, to address and engage the ways that brain science and its technologies are being employed in various settings, ranging from global health, to public use, to security and defense applications.

In this latter regard, I've had the pleasure as serving as a Senior Science Advisory Fellow to the Strategic Multilayer Assessment branch of the Joint Staff of the Pentagon, working to assess how neural and cognitive science might be utilized for intelligence and military purposes, both by the United States and its allies, as well as in various risk and threat scenarios. As well, I've had the honor of serving as an appointed member of the Neuroethics, Legal and Social Issues Advisory Panel of the Defense Advanced Research Projects Agency (DARPA), working to address ethico-legal and policy issues generated by research and clinical uses of cutting edged neurotechnological developments, such as state-of-the art forms of brain stimulation devices and neuroprostheses.

Currently, I serve as an appointed member of the Department of Health and Human Services (HHS) Secretary's Advisory Council on Human Research Protections; and as a Task Leader and Research Fellow on the European Union's Human Brain Project Ethics and Philosophy Sub-Program Working Group. The common thread in each and all of these prior and current enterprises is the sharp focus upon the actual capabilities and limitations of existing and newly developing neurotechnologies, the importance of developing ethical insight and guidance, and informing and creating regulatory policy based upon both the realistic assessment of technical capacities, and social meanings and uses of any such technical developments.

NC *Is there a lot of public interest in the implications of neuro research? Public interest tends to go in waves - we had nanotechnology and cloning way back; now there's excitement and anxiety about AI and Robots. What are the kinds of questions that those outside your field should have in their minds?*

JG There is steadily growing interest in neuroscience and its technologies that has been both responsive to, and in some cases may instigate funding the development and sustenance of large scale neuroscientific programs in the United States (such as the Brain Research through Advancing Innovative Neurotechnologies - BRAIN - initiative which commenced in 2013 and will be formally winding down this year), and worldwide (such as the EU's ongoing Human Brain Project -HBP; and concerted efforts in a number of other countries, including China, and Israel).

In many ways, prior endeavors in other areas of science and technology, such as genetics, and nano-, bio-, robotic and computational engineering, are important to the momentum of brain science, as techniques and tools of these other fields are being increasingly incorporated and used in and by the neurosciences. Neuroscience has become very much a convergent field, which entails and employs a number of disciplines, both within the physical and natural sciences, to include molecular biology, biochemistry, physics, engineering, and ever more, the social and political sciences, and humanities.

I'm fond of saying that the focus and uses of neuroscience and its technologies span from the sub-cellular to the socio-cultural scales. These various levels of current and potential utilization can give rise to a host of ethical and policy-related issues, questions and problems that demand current and ongoing attention. In the main, I'd characterize these as those that are inherent to the neurotechnology; and those that are derivative to such research and use, relative to their social implications and effects. [1]

Under the former, there are questions of safety, the nature and extent of actual capabilities, and possibilities of unanticipated

and/or yet unknown effects. These new tools may reveal aspects of the structure and function of the brain that were heretofore not evident or understood, and thus it will be important to tread forward carefully, and with preparation for certain burdens and risks, with a view toward better defining if and how new and extant technologies should or should not be employed.

This then brings forth socially relevant issues, such as the meaning and value we place upon neuroscientific information and tools; implications of neurotechnologically-derived information for concepts about the nature of mind, self, free will, personhood, morality, medical and social norms; contingencies of informed consent, and distribution and access to these techniques and technologies. [2] Given the novelty of the tools at hand I believe that it's first and foremost important to realistically appraise what we know and don't know about the brain, and what we know and don't know about the technologies and their effects upon the brain.

Simply put, we need to accurately assess and define what these new technologies can and cannot do, need to be scrupulous in our ability to parse fact from fiction, and need to avoid over- and under-estimations and appropriations of these technologies in various uses and settings. This is my principal concern. I'm less worried about the iterative development of ever more sophisticated neurotechnologies than I am about misinterpretation and/or misrepresentation of what they can do, and their potential misuse - or in some cases purposely re-directed use - in ways that can incur a host of burdens and harms.

Of course this is important in and to medicine, most widely in neurology and psychiatry, but this has broader importance, given that neuroscience and technology are being employed in and for purposes beyond medical care. [3] For example, there is much debate about whether certain interventions constitute a treatment or an enhancement, and to what extent such potential optimizations of human performance should be taken. [4] These interventions need not be restricted to the clinic. There is a growing interest in, and availability of direct-to-consumer neurotechnologies that are intended to affect mood, arousal, and cognitive capability; [5] and

there is a dedicated "do-it-yourself" community that is involved in creating types of non-invasive brain stimulation devices, and neuroactive substances. Additionally, ongoing discourse centers upon the validity and value of using neurotechnologically-based assessments in legal proceedings to ascertain dispositions to patterns of thought and/or acts, and to provide contributory evidence for determination of guilt, and/or to affect sentencing. [6] Last, but certainly not least, is the potential utility of many forms of neuroscientific techniques and technologies in security and military operations, and here there are growing concerns about the weaponization of neuroscience. [7]

In each and all of these domains, it is critical to query whether the technologies are sufficiently well understood and developed to support their use, to address the specific ethical issues and problems, and to inform and base any formulation of guidelines and policies upon factual analyses of technical capabilities, limitations and ethical address and identified obligations. I've recently proposed a multi-step approach to the assessment and mitigation of risks in neurotechnology development and use; [8] but while this process is relatively straightforward in its design and goals, it will not be simple to articulate in practice, at least not universally. This is because neuroscience and neurotechnology research, development and use are, and will be ever more enacted on an international scale.

But neurotechnology is a product and tool of developed countries, and this has resulted in asymmetries in research, use and power. Attention must be paid to the medical, social, economic, and political issues and problems generated by these inequalities. Thus, discourses and deliberations about the ethics and regulatory policies that guide and govern neuroscience and technology research and its translation in the various aforementioned spheres must be sensitive and responsive to both local and global effects; and therefore must involve multi-national, multi-disciplinary participants who are representative stake- and shareholders. [9]

NC You spend part of your working life in Europe, have an appointment in a German University, and are engaged in the European Union's Human Brain Project. As a European who still travels to Europe quite a bit I enjoy what I call the parallax - and wish Europeans better understood the U.S. approach to S and T, and vice versa. I don't want to put words in your mouth, but would love to have your comment on how you find working in these two distinct worlds.

JG I, like you, very much enjoy what you've called "the parallax" that working both in the US and Europe enables, and I do think the view from the EU is a bit different. In the main, I think it's a consequence of the multi-national perspectives afforded, and the dialectical orientation and discourses that those perspectives allow. The Human Brain Project (HBP) is a European effort, and tends to be seen - and undertaken - in a multi-national light. The BRAIN initiative, on the other hand, while certainly recognizing the current state of international brain science and key achievements that can be gained through collaboration, is very much an American enterprise in its activities and, at least to some extent, perspective.

In some ways these two endeavors can be seen as parallel, and in others they can be viewed as differing in their orientation. The HBP began as a very basic science effort, with objectives to model and reverse engineer systems and pathways of the brain. Important to this was the need to acknowledge and address philosophical, ethical and social questions, issues and concerns fostered by brain research, and its eventual uses in medicine and the elsewhere in the public sphere. The BRAIN initiative, growing somewhat from the previous Congressionally-declared Decade of the Brain (1990-1999), was specifically aimed at creating new technologies that could be applied to diagnose and treat neurological and psychiatric disorders.

But these are not, nor should they be mutually exclusive. To the contrary; I think there's considerable merit to such a "both-and," versus an "either-or" approach. For example, recently there was expressed discontent from a number of EU scientists about the focus and scope of HBP activities, with call for a greater alignment with more translational applications, such as those axiomatic to the

BRAIN initiative. But, there has also been a move in the US to adopt a more internationalized stance toward brain research and the ethics and policies that guide it, in much the way that the HBP has proceeded to date.

Such postures can be seen as beneficial, as they help to shape the agendas of current and future programs in brain science to become more internationally relevant and cooperative. This is vital, because the outcomes and products of these projects will be used in ways that are sometimes unique to particular nations' needs, values and norms, and at other times, will be utilized in more global contexts of socio-culturally diverse environments. Discussions about science and technology, their social effects, and of the ethics and policies that address and direct S and T need to acknowledge these dimensions and settings of application. [10]

Efforts in the US and the EU are aimed at understanding the structure and activities of the brain; is the plan to map the brain once and for all?

Certainly, developing multi-scalar, comprehensive maps of the brain is a goal. But, this is an enormously complex and labor-intensive undertaking, which will require the integration of a vast amount and various types and levels of data. This necessitates a 'big data' approach, and calls for the use of existing computational tools, and the development of new methods, technologies and models. In short, many of the objectives of the HBP and the BRAIN initiative simply cannot be achieved absent an effective big data toolkit.

However, I think that it's also important to ask what we are going to do with these data - both while in the process of creating such brain maps, and if and when these maps are made. This opens up a proverbial Pandora's Box of questions and issues, including if, how and by whom such data will be accessed, assessed and used; and brings to light the normative implications of functional brain maps - not only in medicine, but as previously mentioned, in law, education, and in other social and perhaps even political contexts. So, while there have been discussions and formulation of certain

guidelines and policies about big data use, these are far from complete, and these are issues with which we continue to wrestle.

NC Ray Kurzweil has been saying for a long time that machine intelligence will soon be able to mimic the brain - and then do better. How does a claim like that look from the perspective of someone whose working life is in the neuro world?

JG It's certainly an interesting assertion, and a bit provocative, as well. I don't doubt that computational engineering will create ever more capable forms of machine intelligence. Some will employ platforms that are modeled upon neural systems, while others will side-step some of the constraints of neural architectures. As to whether these computational technologies will mimic if not surpass functional abilities of the human brain, I think an important thing to bear in mind is that computers do certain things, such as large scale complex calculations and data retrieval, as well, if not better than human brains do. But brains do things, such as subtle pattern recognition and operation of multiple simultaneous functions in a constrained physical system better than computers.

That said, this fact does not pose a limitation. Rather, I think that it throws down the gauntlet of both challenge and opportunity. I believe that the most truly innovative and effective development would be a reciprocally cooperative system, in which the biological and machine components both accentuate their mutual competencies, and compensate for their respective limitations and/or weaknesses.

This type of brain-computer interface would obtain multi-scale and diverse types of cognitive competencies, and would overcome some of the spatial and temporal constraints of both systems. I see this as a form of "hybrid vigor"; but it still would represent a hybrid approach. The more compelling, if not contentious question is what a true chimeric human-machine system would entail and obtain.

Obviously, we're not to there yet, but the point at which the hybrid system becomes fully integrated with human structure and

function, what I've referred to as the hybrid boundary, is, I believe, attainable within the next ten or so years. Up- and down-linking information to and from the brain via telemetric devices is already a reality, albeit somewhat rudimentary. But the time from first steps to leaps and bounds is becoming ever shorter, and the possibilities raised by the pace and breadth of this stride are exciting, and, I'd pose, equally laden with a host of concerns. It will be interesting to be part of this evolution.

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I'm delighted to welcome Dr. James Giordano, a leading scholar of brain science and ethics, to our network of Senior Fellows.

I'll leave you to read his extensive bio, but in brief he is Professor in the Departments of Neurology and Biochemistry at Georgetown University, Chief of the Neuroethics Studies Program of the Pellegrino Center for Clinical Bioethics, and holds various senior appointments as an adviser to the U.S. government (including DARPA) and European Union.

We're so pleased to have him join our team, and are discussing how best to engage him in C-PET's programming. Join me in welcoming him!

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James Giordano PhD, MPhil is Professor in the Departments of Neurology and Biochemistry, Chief of the Neuroethics Studies Program of the Pellegrino Center for Clinical Bioethics, and Co-director of the O'Neill-Pellegrino Program in Brain

Science and Global Health Law and Policy at the Georgetown University Medical Center, Washington DC. He is a Task Leader and Senior Research Fellow of the European Union's Human Brain Project, working on neuroethical and regulatory issues in brain science; and serves as an appointed member of the US Department of Health and Human Services (HHS) Secretary's Advisory Council on Human Research Protections. Prof. Giordano was Senior Scientific Advisory Fellow to the Strategic Multilayer Assessment Branch of the Joint Staff of the Pentagon, and an appointed member of the Neuroethics, Legal and Social Issues Advisory Panel of the Defense Advanced Research Projects Agency (DARPA), working to assess medical and dual-use aspects of brain science. As well, he is Visiting Professor of Brain Science and Ethics at the Coburg University of Applied Sciences, Coburg, Germany, and was formerly JW Fulbright Professor of Neuroscience and Neuroethics at the Ludwig Maximilians University, Munich

A neuroscientist and neuroethicist with over 30 years' experience in basic and translational research upon mechanisms of chronic pain and other neurological and psychiatric disorders, his current work focuses upon neuroethical and policy issues arising in and from the use of advanced neurotechnologies in medicine, public life, and national security. He is the author of over 250 publications and 7 books in neuroscience and neuroethics, and 11 governmental whitepapers on bioscience, biotechnology and biosecurity, and is the Co-Editor in Chief of the journal Philosophy, Ethics and Humanities in Medicine, and Associate Editor of the Cambridge Quarterly of Health Care Ethics. Prof. Giordano was awarded a PhD in biological psychology from the City University of New York; was NIEHS post-doctoral fellow in neurotoxicology and neuropathology at the Johns Hopkins University; APA Visiting Fellow in advanced neuroimaging at Harvard Medical School/Massachusetts General Hospital; and completed post-graduate training in bioethics and health policy at the Neiswanger Institute of Loyola University, Chicago. In recognition of his work, he was elected to the European Academy of Science and Arts.

Best regards,

Nigel Cameron

President and CEO
Center for Policy on Emerging Technologies
Washington, DC 20002

I'm delighted that once again we can partner with Forum Global in the next Internet of Things Summit. As those who follow these newsletters will know well, C-PET has long been focused on IoT. In fact, we co-hosted the first ever Washington IoT

conference, and for some years now we have been working with Forum both in the District and in Europe to advance the best thinking on the policy, commercial, and broader implications of this extraordinary technology.

So plan to join me in Brussels on April 19 and 20! Once again our Senior Fellow Dan Caprio of The Providence Group, who joined us in hosting that first event seven years back, is participating.

Here are some details and registration options. Let me know if you would like further information.

Best regards,

Nigel Cameron
President and CEO
Center for Policy on Emerging Technologies

As Prime Minister Trudeau visits Washington, we're delighted to welcome distinguished Canadian scholar Monica Gattinger to the C-PET International Advisory Board.

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Dr. Gattinger is Director of the University of Ottawa's Institute for Science, Society and Policy; and Associate Professor of Political Studies in the University of Ottawa.

Her expertise spans two very different fields: U.S./Canadian economic integration, and Canadian federal and provincial cultural policy.

Most recently, she is co-editor with Diane Saint-Pierre (INRS-UCS) of *Les politiques culturelles provinciales et territoriales du Canada: Origines, évolutions et mises en oeuvre* (PUL, 2011) and co-editor with Geoffrey Hale (Lethbridge) of *Borders and Bridges: Canada's Policy Relations in North America* (Oxford, 2010). With G. Bruce Doern (Carleton/Exeter), she co-authored *Power Switch: Energy Regulatory*

Governance in the Twenty-First Century (University of Toronto Press, 2003). Professor Gattinger is currently authoring a book on Canada-US energy and energy-climate change relations since the coming into force of the Canada-US Free Trade Agreement.

Join us in welcoming her to the C-PET network!

Best regards,

Nigel Cameron
President and CEO
Center for Policy on Emerging Technologies
Washington, DC

Next up in our series on Critical Infrastructure:

February 23: Securing the Internet of Things: Critical Infrastructure and Cybersecurity

Senior Fellows Daniel Caprio and Jody Westby on *Securing the Internet of Things: Critical Infrastructure and Cybersecurity*. February 23 at 2:00 p.m. eastern.
[Please register here](#)

Daniel Caprio, *Co-founder and Executive Chairman of The Providence Group*, and Jody Westby, *President of Global Cyber Risk*, will discuss security priorities as the Internet of Things is rapidly commercialized and integrated into our homes, our cities, and potentially every aspect of our infrastructure.

Daniel Caprio has served as the Chief Privacy Officer and Deputy Assistant Secretary at the Commerce Department, a transatlantic subject matter expert for the European Commission's Internet of Things formal expert group, a Chief of Staff for a Federal Trade Commission Commissioner and a member of the Department of Homeland Security Data Privacy and Integrity Advisory Committee.

Jody Westby serves as Adjunct Distinguished Fellow to Carnegie Mellon CyLab. She was lead author on Carnegie Mellon's Governing for Enterprise Security Implementation Guide, which was developed for boards and senior management. She is also co-chair of the American Bar Association's Privacy and Computer Crime Committee and was chair, co-author and editor of its International Guide to Combating Cybercrime, International Guide to Cyber Security, International Guide to Privacy, and Roadmap to an Enterprise Security Program (endorsed by the Global CSO Council). She is author of the Legal Guide to Cybersecurity Research and the Legal Guide to Botnet Research, published by ABA Publishing in July 2013.

Best regards,

Nigel Cameron
President and CEO
Center for Policy on Emerging Technologies
Washington, DC 20002

Innovation for Infrastructure Resilience: Renewing America's Infrastructure

Robert McCreight,

**Senior Fellow, C-PET
Senior Fellow, George Mason University, Center for Infrastructure Protection,
School of Business**

Background

America's fragile, decrepit and sadly overstressed infrastructure as of 2016 includes railroads, highways, bridges, electric grid systems, water supply systems, food supply systems, telecommunications, banking, public health and safety systems along with other crucial aspects of infrastructure which require immediate and urgent action. Determining what priority remedial measures are needed, triggering the invocation of pragmatic and effective remedial steps and the all important infusion of financial and managerial resources simply cannot be understated. Deciding what must be fixed, improved, repaired, replaced and upgraded includes three basic decisions:

- 1-which infrastructural systems are critical to socio-economic security?
- 2-which infrastructural systems are essential but secondary to security
- 3-what technologies, strategies and methods enable and sustain more resilient infrastructures to emerge for the period 2020-2070?

The overall goal of resilient infrastructures specifically entails engineered ingredients and mechanisms which provide a robust level of resilience against...

- natural disasters
- terrorism
- catastrophic and cascading systems failures
- operator error and accident
- hostile actions by enemies engaged in warfare

Without some reliable assurances that these five contingent threats can be equally resisted and overcome by the deliberate engineering and systems design strategies embedded in resilient infrastructures of the future our nation misses a crucial opportunity to safeguard, strengthen and sustain those critical infrastructures we deem critical to our nation's security and survival.

Critical Assumptions and Program Elements

As we move forward in the interim planning period 2017-2019 to identify, prioritize and schedule specific aspects of infrastructure resilience certain key assumptions prove paramount in determining the rate of success in such comprehensive multiyear

and multi-billion dollar ventures. Some of these assumptions are:

- networks of government, military and private sector experts will be involved
- university schools of engineering and engineering firms will be involved
- Congress will allocate R&D funds for the first 2 years to validate test concepts
- Expert groups will discuss and agree in those critical infrastructures to be 1st
- Expert groups will designate secondary essential infrastructures for later action
- Pilot ventures in resilience technology development will be funded for 5 years

At least three other key components of the overall infrastructure resilience strategy are considered fundamental to support and sustain this multiyear effort...

- strong commitment to technology innovation for each distinct infrastructure
- strong commitment to sharing innovative technologies and concepts
- proof of concept testing for rigorous demonstrations of actual resilience

The vital program elements which enable this concept to move forward and attain some level of reliable public, private and Congressional endorsement include consideration of a few variables which are intended to expedite the identification and prioritization of those selected infrastructures where their inherent criticality merits immediate investment and sustained public support. Some of the elements include, for example,

- infrastructure innovation teams in each of 50 states led by state governors
- infrastructure innovation teams involving schools of engineering for critical systems
- infrastructure innovation teams soliciting external/foreign resilience strategies
- infrastructure innovation venture capitalists investing in creative inventors

Focus of Future Projects and Research

One crucial aspect of the infrastructure resilience effort where innovation is encouraged and rewarded is to comprehensively examine new and novel ways of devising and adapting technologies [both linear and convergent] which enhance the odds of finding systems which exhibit harder levels of resilience against the five major threat criteria. Some of these future projects assigned for the period 2020-2025 with substantial public and private funding behind them include--

- materials research in redundant and resilient technologies
- developing new composites, novel elements and structural innovations
- devising autonomous repair and resilience factors via hyper-engineering
- developing 'black start' system restoration technologies for all infrastructures
- devising system safeguards which curtail or restrict normal cascading of infrastructures
- finding solar, cyber, genomic mechanisms to harden infrastructures against failures
- developing robust system security measures and technologies far beyond current systems

This multiyear and multi-billion dollar effort should generate real payoffs within 5 years of launch provided genuine stress testing, validation and proof of concept measures can be undertaken in the first few years to highlight pathways to better and more resilient technologies and relevant strategies.

@RMcCreight

From earlier newsletters:

As the new administration prepares to take office, it seems apposite to share the five questions I posed in an op-ed for the San Francisco Chronicle back when the campaigns were just gearing up. It would have been nice had they framed the discussions, don't you think?

OPINION

5 tech questions we need our presidential candidates to debate

By Nigel M. de S. Cameron

September 3, 2015 (Print: Sunday September 6)

Like many Americans being born today, my grandchildren probably will be living a decade or more into the 22nd century. Yet our presidential candidates, whether Democrats or Republicans, whether in their 70s or their 40s, seem terminally locked in the 20th. This is painfully obvious now that we're in debate season and every question asked of the presidential candidates is rooted in the past.

"Judge a man by his questions rather than his answers," wrote Voltaire in the 18th century. It's the questions that frame the discussion. What's missing from the presidential debates is not simply questions about technology but how dramatic technological change is shifting the entire landscape - social, political, economic, even geographic.

Here are five key questions we need our candidates to debate:

1 How does America emerge as pro-jobs as well as pro-tech in the 21st century? We're already worried about outsourcing jobs overseas, but what about outsourcing them to machines? When will we get a startup in Silicon Valley that needs a lot of workers? Kodak, our photo leader for generations, once had 145,000 employees. Instagram, which has replaced it, had precisely 13 when Facebook bought it for \$1 billion.

2 How would the candidates prioritize and handle the major risk issues of our time? We need a debate on the risks faced by this nation and the human race. This is the best context for thinking about climate change. What about antibiotics? The World Health Organization says we may have to live without them as antimicrobial resistance has made many of them ineffective - a scenario with human impact as great as the worst climate scenarios. Should we worry about artificial intelligence running out of control? Let the candidates stand in front of a white board with a simple risk matrix and tell us where they plot these issues.

3 What about shifting Camp David to Palo Alto? We need a debate on how to bring the creativity of Silicon Valley into fundamental alignment with the way in which this nation is led and governed from Washington. Hiring West Coast techies to work in the District of Columbia has been helpful, but it scarcely touches the core issue of the corporate culture of our government. Or to be radical - should the U.S. government be moved to the West Coast? (That may just be a matter of time.)

4 What are the ways the U.S.-led tech revolution can prove the most beneficent force that planet Earth has yet known? Have them name the ways to do good - and be loved for it. Would they include Massive Open Online Courses (MOOCs or web-based education programs) to deliver free global college education? Fund nanotechnology to enable pure water for every family? Use social media to reshape the possibilities not merely for revolt but also for new, accountable governance (both in politics and our great corporations)?

5 How do we handle the David-and-Goliath challenges the tech revolution has enabled - the so-called asymmetric threats, that is, threats from small groups with small resources who can now challenge great nations with devastating results? Think al Qaeda or Islamic State. Or individuals - from Julian Assange to Edward Snowden. Asymmetries will come to occupy the best efforts of governments, and David always will be a very tricky challenge for Goliath. Unless we understand them, we lose. How to sustain American leadership in an asymmetric world may be the most challenging of all questions.

Democracies have a serious problem, and it's called the short term. As the exponential changes driven by the tech revolution ramp up ever faster - and anticipating the future becomes increasingly central to today's decisions - the problem will only get worse. We need leaders from the left, the right and libertarian viewpoints who are at home in a rapidly shifting world, and comfortable with tomorrow's questions.

Technology may not all be wonderful, or inevitable, but if we believe the human questions - human rights, human dignity, a human future - are central to the tech-driven 21st century, we shall need savvy leaders to take America forward. So when the 22nd century dawns, our grandchildren will thank us.

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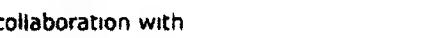
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